



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

No endorsement of AgEcon Search or its fundraising activities by the author(s) of the following work or their employer(s) is intended or implied.

**The 45th Annual Conference of the Australian
Agricultural and Resource Economics Society**

**Adelaide, Australia
January 22-25, 2001**

**An Alternative Approach to Measure Regional
Comparative Advantage in China's Grain Sector**

**Zhong Funing
Xu Zhigang
Fu Longbo**

**College of Economics & Trade
Nanjing Agricultural University
Nanjing, China**

An Alternative Approach to Measure Regional Comparative Advantage in China's Grain Production

Zhong Funing, Xu Zhigang and Fu Longbo¹

I. Introduction

China is the largest country in the world measured in population, the third largest one measured in land surface, and has the longest history of continuing civilization among all nations. It is natural to assume that the significant differences in natural resource endowments and in the levels of economic development among various regions would have led to diversified cropping systems and production techniques in the grain sector across China during her long history, as well as in all other sectors. Those differences constitute the bases of regional comparative advantages, which in turn will influence patterns in further development across the country.

In a market economy, regional comparative advantage may lead to diversified production and exchange of products among regions, and can be measured with the types and volumes of goods transacted regionally and/or internationally. However, it may not be the case in China's grain sector. As many research have documented, the government control on grain production and marketing, and the under-developed marketing infrastructure have prevented China's grain producers from fully realization of regional comparative advantage in grain production, and there is significant potential in improving the resource allocation efficiency based on regional comparative advantage. It is also reasonable to assume that the volumes of regional grain shipments are not a good indication of regional comparative advantage, so any policy aiming at such improvement should seek alternative measurements.

This study tries to measure regional comparative advantage in China's grain production with direct production and cost indicators instead of the trade flow data. It is expected that the formers are able to reveal the underlying but not yet realized regional comparative advantage in the sector. Many previous studies have adopted this approach by comparing China's production costs with international levels, and some analyses have measured China's production costs at provincial level. However, in addition to more systematic comparison, there may be one significant step-forward in this study. Instead of determining which province, among all major producers in the country, has the lowest production cost in a crop, we are trying to determine for each province which crop, among all major crops in the province, requires lowest costs in relative terms. It is believed that such criterion is more consistent with the theory of comparative advantage, as it can provide the correct direction to structural adjustment even one province has higher production costs in all crops compared with other major producers and/or national (international) averages.

As such, the approach and finding of this study might be of interests to many researchers, and may provide new directions for future study. It is believed that the finding of this study may help the Chinese policy makers to understand how and to what extent they can adjust their policy in order to improve resource allocation, and help grain producers to foresee in what directions they will be able to change their production structure. The finding of this study may also have important implication in

¹ Dr. Zhong is a Professor and the Dean of the College of Economics & Trade, Nanjing Agricultural University, Nanjing, China. Mr. Xu and Dr. Fu are a Ph.D. candidate and a Lecturer, respectively, at the College.

international grain trade, as China is approaching to joining the WTO and to opening her grain market to a larger extent.

II. Analytical framework

Domestic Resource Costs (DRC) are widely used to measure comparative advantages in production of any commodity in a country². Basically, the DRC measures the opportunity costs of producing specified goods with reference to border prices for both inputs, especially imported and/or tradable, and outputs. It shows how much domestic resource, in value terms, has to be used in order to earn or save a unit of foreign exchange. A comparison between the calculated DRC and an appropriate indicator of foreign exchange rate may tell us if it is economically beneficial for the country to produce the goods.

Once a foreign exchange rate is chosen, a Domestic Resource Costs Coefficient (DRCC) can be obtained by dividing the DRC with the exchange rate. If the value of DRCC equals one, then the opportunity costs of domestic production is exactly the same as the costs of imports, or the foreign currency earned from exports. If that value is less than one, it implies that domestic production costs are less than imports. In this case, it is believed that the country has comparative advantage in producing the specified goods. The same reasoning holds in the case of DRCC value being greater than one, in which the country has comparative disadvantage in producing the goods.

However, there is a departure from classical Ricardo's theory of comparative advantage in the above approach. A Ricardian model requires comparing production of two goods between two countries, without counting domestic output prices and exchange rate. The DRCC measures only one goods at a time, implicitly assuming all other goods are grouped into one and expressed by the chosen exchange rate. A danger from this approach is that the implicit assumption may not hold. If the exchange rate is distorted, the values of DRCC might be over-estimated or under-estimated, showing a country having comparative advantages (or disadvantages) in all or most of goods produced, which is not true.

The same argument applies to measuring regional comparative advantages within a country. Therefore, in this study, the ranks, i.e., the relative values, rather than the absolute values, of DRCCs of will be taken as indicators of regional comparative advantages in grain production among provinces in China. This calculation will be carried out for each main grain crop, showing regional comparative advantages in producing that grain crop. At the same time, the ranks of national average DRCCs of all major grain crops may indicate China's comparative advantage or disadvantage in producing those crops, against world market situation.

Another similar question must be answered: How about if a province has comparative advantages or disadvantages in producing most grain crops? What can indicate the possible direction of structural adjustment in the grain sector in this case? A plausible solution is the ranks of the DRCCs of various grain crops within any specific province, which suggest the relative comparative advantages in producing various grain crops in a province, rather than the relative comparative advantages of various provinces in producing a specific grain crop. Obviously the two indicators are

² See Bruno, 1972 and Pearson, 1973, for example.

both important in measuring China's regional comparative advantages in grain production, and a province's comparative advantages in producing various crops may be more important in determining the direction of structural adjustment in that province.

Furthermore, the purpose of measuring regional comparative advantage is to show the direction of structural adjustment in the cropping sector. As such, the comparison must be made among provinces with similar cropping pattern. In northeast and north China where farmers have only one harvest a year, each crop competes with others for similar resources. However, two or three harvests per year are common in the south, so crops do not necessarily compete with each other. For example, if a southern province has a lower value of DRCC in wheat and a higher one in corn compared with a province in northeast China, we can not conclude that this province should expand wheat production while reducing areas sown to corn. As these two crops are grown sequentially in different seasons in the south, they do not compete for resources and hence are not substitutions for each other.

Therefore, it is necessary to compare each province's relative advantage within a certain region where the cropping system is more comparable. For simplicity, this study divides the whole China into three big regions:

- 1) north where one harvest per year is dominant;
- 2) central where two crops per year are very common; and
- 3) south where two or three crops a year.

III. Model and data

As described above, this study uses Domestic Resource Costs (DRC) as the bases in measuring regional comparative advantage in China's grain production. The DRC measures the necessary total costs of domestic resources required in one activity in order to earn (or save) one unit of foreign currency:

$$DRC_j = \frac{\sum_{s=1}^m F_{sj}V_s - E_j}{U_j - M_j - R_j} \quad (1)$$

Where DRC_j = the domestic resource costs required in the j^{th} activity,

F_{sj} = the quantity of the s^{th} input used in the j^{th} activity;

V_s = the opportunity cost of the s^{th} input;

E_j = the externality of the j^{th} activity;

U_j = the gross value of the j^{th} activity measured at border prices and in foreign currency;

M_j = the total value of all imported and/or tradable inputs measured at c.i.f. and in foreign currency; and

R_j = the total opportunity costs of all foreign-earned factors and in foreign currency.

The numerator of the equation is the total costs of domestic resources used in the activity in local currency, and the denominator is the total foreign exchange earned (or saved) from the same activity. So the quotient is the implied exchange rate resulted

from carrying out the j^{th} activity.

Therefore, if a shadow price of foreign exchange rate is denoted as V , the following conclusions hold:

1. If $DRC_j = V$, then the j^{th} activity is at break-even point;
2. If $DRC_j < V$, then the j^{th} activity has a comparative advantage;
3. If $DRC_j > V$, then the j^{th} activity has a comparative disadvantage.

A Domestic Resource Costs Coefficient (DRCC) is defined as the DRC divided by the shadow price of foreign exchange, V :

$$DRCC_j = \frac{DRC_j}{V} \quad (2)$$

The following conclusions also hold:

1. If $DRCC_j = 1$, then the i^{th} activity is at break-even point;
2. If $DRCC_j < 1$, then the i^{th} activity has a comparative advantage;
3. If $DRCC_j > 1$, then the i^{th} activity has a comparative disadvantage.

Furthermore, the extent to which one activity has a comparative advantage or disadvantage could be measured by how much its value of DRCC is less or greater than one. Although the original usage of the DRCC is to measure the comparative advantage of one activity in a country against international standards, the relative comparative advantages among activities and/or across regions could also be compared based on DRCCs.

As analyzed above, the ranks of the DRCCs in each crop by province or each province by crop in a comparable region are more meaningful in determining the direction of structural adjustment. So the calculated DRCCs for various grain crops in each province will be ranked within one of the three big regions in two ways. Firstly, they will be ranked by crop, showing which province has comparative advantage in producing that crop in the region. Secondly, they will be ranked by province, indicating each province's comparative advantage in producing what crop. The two sets of results will be compared, and the conclusions for structural adjustment will be drawn based on comparison of the results.

In order to make the ranking consistent, one more step should take, i.e., to normalize the DRCCs for all crops in all provinces in a region by dividing them with the averages of the region. That is, a ratio of a DRCC for a crop in a province against the respective regional average is calculated first, and then the ratio is used in the ranking. This kind of ranking will give more precise figures with regard to the relative comparative advantages of one province in producing various crops in that region, and with regard to the relative comparative advantages of various provinces in producing the same crop in the region as well.

The ratio of the DRCCs to their averages, RDRCC, is given as follows:

$$RDRCC_{ij} = \frac{DRCC_{ij}}{DRCC_i}. \quad (3)$$

Where $DRCC_{ij}$ is the DRCC for a crop produced in the j^{th} province, i^{th} region;
 $DRCC_i$ is the average of the DRCC for the same crop in that region; and
 $RDRCC_{ij}$ is the ratio of the above two figures.

The cost-benefit data for main grain crops are directly used in calculating DRCCs in each province³. Other data, such as land cost, border prices for imports and exports, subsidies to inputs, marketing and transportation costs, depreciation of fixed assets, tax, etc., are all estimated with best available information, which will not be discussed here. To avoid irrational fluctuations due to whether and other random factors, 1996-98 averages are used in the calculations.

³ State Development and Planning Commission et. al.(ed.) Compilation of National Cost-Benefit Data of Farm Products (Quanguo Nongchanping Chengben Shouyi Ziliao Huibian). Beijing: China Price Press, various issues.

IV. Empirical results

The DRCCs are calculated for 9 major grain crops produced in China by province, and the results are listed in Table 1.

Table 1 DRCCs of Main Grain Crops in China, by Province

	J. Rice	E. Rice	M. Rice	L. Rice	Wheat	Corn	Soybean	Sorghum	Millet
National	0.71	0.90	0.77	0.85	1.00	0.94	0.95	0.76	0.82
Beijing	1.01	-	-	-	0.98	1.06	-	-	-
Tianjin	0.80	-	-	-	0.77	0.71	-	-	-
Hebei	0.78	-	-	-	0.76	0.68	0.73	1.61	0.67
Shanxi	0.62	-	-	-	0.78	0.88	1.03	0.67	0.65
Inner Mongolia	0.96	-	-	-	0.87	0.82	0.97	0.66	0.86
Liaoning	0.74	-	-	-	1.03	0.93	0.91	0.71	0.98
Jilin	0.61	-	-	-	1.08	1.07	0.71	0.96	0.42
Heilongjiang	0.79	-	-	-	0.91	0.89	0.87	0.75	-
Shanghai	0.70	-	-	-	0.90	-	-	-	-
Jiangsu	0.76	0.81	1.00	-	1.36	1.28	1.02	-	-
Zhejiang	0.81	1.01	-	0.81	1.19	-	-	-	-
Anhui	0.66	1.01	0.69	0.73	0.94	0.69	0.74	-	-
Fujian	-	0.96	0.93	0.99	1.39	-	1.27	-	-
Jiangxi	-	1.16	-	0.86	-	-	-	-	-
Shandong	0.89	-	-	-	1.00	0.96	0.84	-	-
Henan	0.60	-	0.59	-	0.79	0.78	0.66	-	0.65
Hubei	1.00	1.07	0.92	1.07	1.74	1.35	1.29	-	-
Hunan	-	1.02	-	0.79	1.85	1.16	-	-	-
Guangdong	-	1.07	-	1.04	-	-	-	-	-
Guangxi	-	0.86	-	0.92	-	1.09	-	-	-
Hainan	-	0.74	-	0.95	-	-	-	-	-
Sichuan	-	-	0.66	-	1.21	1.02	-	-	-
Guizhou	0.58	-	0.56	-	1.02	0.86	1.10	-	-
Yunnan	0.61	0.56	0.58	-	0.89	0.78	0.95	-	-
Tibet	-	-	-	-	-	-	-	-	-
Shaanxi	-	-	0.61	-	0.95	1.04	1.12	-	0.84
Gansu	-	-	-	-	0.89	0.81	-	-	1.07
Qinghai	-	-	-	-	0.97	-	-	-	-
Ningxia	0.63	-	-	-	0.83	0.62	0.92	-	-
Xinjiang	0.65	-	-	-	0.77	0.69	-	-	-
Chongqing	-	-	0.69	-	1.43	1.21	-	-	-

Note: J. Rice = *Japonica* rice, E. Rice = early rice (*Indica*), M. Rice = middle rice (*Indica*), and L. Rice = late rice (*Indica*). All DRCC figures are 1996-98 averages.

Source: Calculated with data published in Compilation of National Cost-Benefit Data of Farm Products (Quanguo Nongchanping Chengben Shouyi Ziliao Huibian), 1997-99.

As a general rule, the cropping system and the structure of the cropping sector in a region are determined by climate, topography and other natural resources, as well as human resource accumulated in the past. Therefore, provinces or regions with similar resource endowments are likely to have similar cropping system and structure if isolated from each other. Under a competitive market, any difference in the comparative advantage among those provinces or regions may lead to diversification

of the cropping structure, though they may have the same cropping system, i.e., have the same numbers of harvests a year. However, if the markets are intervened by the government with the aim of self-sufficient in major farm products, the diversification, i.e., the full utilization of regional comparative advantage, is not likely to be realized. It was the case in China before the reform, and is still so during the transitional period. The findings of this study may help policy makers to incorporate detailed information of regional comparative advantages into their intervention measures, in order to improve efficiencies in resource allocation.

Based on natural, economical and social conditions, China is divided into ten regions according to cropping system and structure, and main types of crops⁴:

1. Northeast Region, consisted of Heilongjiang, Jilin, and Liaoning;
2. North Plateau Region, consisted of Inner Mongolia, Shanxi(most part), Shaanxi(central and north), and Gansu(central and east);
3. Northwest Region, consisted of Xinjiang, Gansu(west), Qinghai, and Ningxia;
4. Qingzan Region, consisted of Tibet, Qinghai(south and east), and parts of Sichuan, Gansu and Yunnan;
5. Huang-Huai-Hai Region, consisted of Shanxi(south), Beijing, Tianjin, Hebei, Shangdong, and Henan;
6. Middle and Lower Reaches of Changjiang(the Yangtze River) Region, consisted of Shanghai, Anhui, Jiangsu, Hubei, and northern parts of Zhejiang, Jiangxi and Hunan;
7. South Hills Region, consisted of Zhejiang, Jiangxi, Hunan, and Fujian;
8. Chuan-Shaan Basin Region, consisted of Sichuan, and Shaanxi(south);
9. Yun-Gui Plateau Region, consisted of Yunnan, and Guizhou;
10. South Region, consisted of Guangdong, Guangxi, Yunnan(south), and Hainan.

For the purpose of this study, i.e., to investigate the potential competition of resource allocation among crops within provinces and/or regions with similar cropping system (having the same number of harvests per year), the 10 regions are further grouped into 3 big regions: north, central, and south. Restricted by data availability, the division of the 3 big regions is along the provincial boundaries, and the regional average DRCCs and RDRCCs are calculated accordingly. Based on figures listed in Table 2, Table 3 shows the relative advantages in producing various grain crops in each of the 3 big regions, and Table 4 indicates the relative advantages of the 3 big regions in producing the same crop.

It can be found out that China has relatively strong comparative advantages in rice, sorghum and millet production, but not so in wheat, soybean and corn production. If the comparative advantages are ranked according to DRCCs, then, a list from the highest to lowest reads: *Japonica* rice, sorghum, middle *Indica* rice, millet, late *Indica* rice, early *Indica* rice, corn, soybean, and wheat. It suggests that, compared with world market situations, China should produce more rice, especially *Japonica* varieties, and millet, but less wheat, soybean and corn.

Table 2 DRCCs of Main Grain Crops in China, by Region

J. Rice	E. Rice	M. Rice	L. Rice	Wheat	Corn	Soybean	Sorghum	Millet
---------	---------	---------	---------	-------	------	---------	---------	--------

⁴ National Agricultural Zoning Committee: China Agricultural Resources and Zoning (Zhongguo Nongye Ziyuan Yu Quhua).

National	DRCC	0.71	0.90	0.77	0.85	1.00	0.94	0.95	0.76	0.82	
North	DRCC	0.72	-	0.61	-	0.91	0.86	0.93	0.75	0.80	
Central	DRCC	0.79	1.01	0.80	0.85	1.09	0.96	0.90	1.14	0.66	
South	DRCC	0.67	0.92	0.67	0.91	1.24	1.02	1.11	-	0.84	

Note: J. Rice = *Japonica* rice, E. Rice = early rice (*Indica*), M. Rice = middle rice (*Indica*), and L. Rice = late rice (*Indica*). All DRCC figures are 1996-98 averages.

Source: Calculated with data published in Compilation of National Cost-Benefit Data of Farm Products (Quanguo Nongchanping Chengben Shouyi Ziliao Huibian), 1997-99.

Figures in Table 3 indicate that, if compared crop by crop, the North Region is best in producing middle *Indica* rice, wheat, corn, and sorghum, while the Central and South Regions are best in producing late *Indica* rice, soybean, and millet, and *Japonica* rice and early *Indica* rice, respectively. If the relative advantages in producing various crops in each region are concerned, then, Table 4 suggests that the north region should consider expanding production of middle *Indica* rice first, then wheat, corn, and sorghum, while reducing *Japonica* rice, millet, and soybean. The Central Region may increase millet, soybean, and late *Indica* rice production, but reduce other grain production. The south Region is likely to produce more middle and early varieties of *Indica* rice, as well as *Japonica* rice, but less other grain crops.

There are some differences in drawing policy implications between Table 3 and Table 4, although the suggestions are the same for the north and central regions in the two tables. It may be found out in Table 3 that the South Region is ranked first in *Japonica* and early varieties of *Indica* rice, but second in middle *Indica* rice, suggesting increasing *Japonica* and early varieties of *Indica* rice production first and then middle *Indica* rice production. However, the ranking in Table 4 clearly suggests that the South region should expand middle *Indica* rice first, and then *Japonica* and early varieties of *Indica* rice may be considered one by one.

The reason lies in the “real “ meaning of comparative advantage. Although the South Region has lower RDRCCs in all of the three grain crops as suggested by ranking in the respective crops, the comparative advantage in producing middle *Indica* rice is relatively stronger measured by the rank of producing all major grain crops in that region. Therefore, the ranking in Table 4 will be used in draw conclusions, and the same logic applies to late analyses of comparative advantages of provinces in each region.

Table 3 RDRCCs of Main Grain Crops in China, by Crop

		J. Rice	E. Rice	M. Rice	L. Rice	Wheat	Corn	Soybean	Sorghum	Millet	
National	DRCC	0.71	0.90	0.77	0.85	1.00	0.94	0.95	0.76	0.82	
	DRCC	0.72	-	0.61	-	0.91	0.86	0.93	0.75	0.80	
North	RDRCC	1.01	-	0.79	-	0.91	0.91	0.98	0.97	0.98	
	RANK	2	-	1	-	1	1	2	1	2	
	DRCC	0.79	1.01	0.80	0.85	1.09	0.96	0.90	1.14	0.66	
Central	RDRCC	1.11	1.12	1.04	1.00	1.09	1.02	0.95	1.50	0.80	
	RANK	3	2	3	1	2	2	1	2	1	
	DRCC	0.67	0.92	0.67	0.91	1.24	1.02	1.11	-	0.84	
South	RDRCC	0.94	1.02	0.87	1.07	1.24	1.09	1.17	-	1.02	
	RANK	1	1	2	2	3	3	3	-	3	

Note: J. Rice = *Japonica* rice, E. Rice = early rice (*Indica*), M. Rice = middle rice (*Indica*), and L. Rice = late rice (*Indica*). All DRCC figures are 1996-98 averages.

Source: Calculated with data published in Compilation of National Cost-Benefit Data of Farm Products (Quanguo Nongchanping Chengben Shouyi Ziliao Huibian), 1997-99.

Table 4 RDRCCs of Main Grain Crops in China, by Region

		J. Rice	E. Rice	M. Rice	L. Rice	Wheat	Corn	Soybean	Sorghum	Millet	
National	DRCC	0.71	0.90	0.77	0.85	1.00	0.94	0.95	0.76	0.82	
	DRCC	0.72	-	0.61	-	0.91	0.86	0.93	0.75	0.80	
North	RDRCC	1.01	-	0.79	-	0.91	0.91	0.98	0.97	0.98	
	RANK	7		1		2	3	6	4	5	
	DRCC	0.79	1.01	0.80	0.85	1.09	0.96	0.90	1.14	0.66	
Central	RDRCC	1.11	1.12	1.04	1.00	1.09	1.02	0.95	1.50	0.80	
	RANK	7	8	5	3	6	4	2	9	1	
	DRCC	0.67	0.92	0.67	0.91	1.24	1.02	1.11	-	0.84	
South	RDRCC	0.94	1.02	0.87	1.07	1.24	1.09	1.17	-	1.02	
	RANK	2	3	1	5	8	6	7		4	

Note: J. Rice = *Japonica* rice, E. Rice = early rice (*Indica*), M. Rice = middle rice (*Indica*), and L. Rice = late rice (*Indica*). All DRCC figures are 1996-98 averages.

Source: Calculated with data published in Compilation of National Cost-Benefit Data of Farm Products (Quanguo Nongchanping Chengben Shouyi Ziliao Huibian), 1997-99.

Figures in Tables 5 through 7 are summary of the rankings of comparative advantages of all provinces⁵ in producing various grain crops within one of the 3 regions. (For comparison, the rankings of RDRCC by crop are listed in Table A-1 to Table A-3 as Appendix.)

Table 5 suggests that, in northeast China, Heilongjiang may consider to expand soybean and wheat production, while Jilin and Liaoning may grow more millet and soybean, and sorghum and soybean, respectively. However, as China has little comparative advantage in wheat, soybean, and corn production (see Table 1 and related analysis), they may try to enlarge areas sown to sorghum, millet, and *Japonica* rice instead unless other provinces or other regions reduce wheat, soybean and corn

⁵ Including minority autonomous regions and municipalities directly under the State Council, but Taiwan, Hong Kong and Marco are not included.

production in a larger scale, or the comparative advantage is very significant in respective province (such as soybean production in Jilin and wheat in Shanxi and Xinjiang). The situation is about the same in Inner Mongolia, Gansu, Qinghai, and Xinjiang, while Shanxi, Shaanxi, and Ningxia may consider to expand *Japonica* and middle *Indica* rice production.

Table 5 RDRCCs of Main Grain Crops in the North Region, by Province

Province		J. Rice	E. Rice	M. Rice	L. Rice	Wheat	Corn	Soybean	Sorghum	Millet
Heilongjiang	DRCC	0.79	-	-	-	0.91	0.89	0.87	0.75	-
	RDRCC	1.11	-	-	-	1.00	1.04	0.94	1.01	-
	RANK	5	-	-	-	2	4	1	3	-
Jilin	DRCC	0.61	-	-	-	1.08	1.07	0.71	0.96	0.42
	RDRCC	0.85	-	-	-	1.19	1.24	0.76	1.29	0.52
	RANK	3	-	-	-	4	5	2	6	1
Liaoning	DRCC	0.74	-	-	-	1.03	0.93	0.91	0.71	0.98
	RDRCC	1.04	-	-	-	1.14	1.08	0.97	0.95	1.22
	RANK	3	-	-	-	5	4	2	1	6
Inner Mongolia	DRCC	0.96	-	-	-	0.87	0.82	0.97	0.66	0.86
	RDRCC	1.35	-	-	-	0.96	0.95	1.04	0.87	1.07
	RANK	6	-	-	-	3	2	4	1	5
Shanxi	DRCC	0.62	-	-	-	0.78	0.88	1.03	0.67	0.65
	RDRCC	0.87	-	-	-	0.86	1.02	1.11	0.89	0.81
	RANK	3	-	-	-	2	5	6	4	1
Shaanxi	DRCC	-	-	0.61	-	0.95	1.04	1.12	-	0.84
	RDRCC	-	-	1.00	-	1.04	1.21	1.20	-	1.04
	RANK	-	-	1	-	3	5	4	-	2
Gansu	DRCC	-	-	-	-	0.89	0.81	-	-	1.07
	RDRCC	-	-	-	-	0.98	0.94	-	-	1.34
	RANK	-	-	-	-	2	1	-	-	3
Qinghai	DRCC	-	-	-	-	0.97	-	-	-	-
	RDRCC	-	-	-	-	1.06	-	-	-	-
	RANK	-	-	-	-	1	-	-	-	-
Ningxia	DRCC	0.63	-	-	-	0.83	0.62	0.92	-	-
	RDRCC	0.88	-	-	-	0.91	0.72	0.99	-	-
	RANK	2	-	-	-	3	1	4	-	-
Xinjiang	DRCC	0.65	-	-	-	0.77	0.69	-	-	-
	RDRCC	0.91	-	-	-	0.85	0.80	-	-	-
	RANK	3	-	-	-	2	1	-	-	-
North	DRCC	0.72	-	0.61	-	0.91	0.86	0.93	0.75	0.80
	RDRCC	1.00	-	1.00	-	1.00	1.00	1.00	1.00	1.00

Note: J. Rice = *Japonica* rice, E. Rice = early rice (*Indica*), M. Rice = middle rice (*Indica*), and L. Rice = late rice (*Indica*). All DRCC figures are 1996-98 averages.

Source: Calculated with data published in Compilation of National Cost-Benefit Data of Farm Products (Quanguo Nongchanping Chengben Shouyi Ziliao Huibian), 1997-99.

In the Central Region as shown in Table 6, in the northern part, Heibei, Tianjin,

Shanxi, and Henan have strong comparative advantages in wheat production as their DRCC values are less than 0.8⁶. Although RDRCC values are also at lowest in wheat production in Beijing and Shangdong, they are relatively high according international standards. Shangdong may choose to expand soybean instead, but Beijing does not have good alternatives. It either produces wheat at relatively less loss, or totally gives up grain production at all.

In the southern part of the Central Region, Anhui has strong comparative advantages in growing corn, soybean, and *Japonica* rice; Jiangsu has strong comparative advantages in early *Indica* and *Japonica* rice production; Zhejiang, Jiangxi, and Hunan have strong comparative advantages in late rice (Zhejiang also has weak comparative advantages in producing early *Indica* and *Japonica* rice); and similar to the situation in Beijing, Hubei has only weak comparative advantages in all rice production.

In the South Region, Zhejiang, Jiangxi, and Hunan have strong comparative advantages in growing late rice, while Yunnan and Guangxi have them in early rice production. However, as late rice is usually grown after harvest of early rice, they are not substitutions for each other. Actually, in the double-rice dominant areas, farmers do not have alternatives in reality, so there is little room for restructuring the cropping sector in the short run. The same conclusion holds for Fujian, Guangdong and Hainan, though they have only weak comparative advantages in grain production.

Sichuan, Chongqing, and Guizhou form another sub-group in the region. They both have comparative advantages in growing wheat. However, the absolute values of DRCCs for wheat are relatively high, and wheat (winter crop) there is not a substitution for rice or corn (summer crops), so we can not suggest expanding wheat production. The three provinces seem to have comparative advantages in middle rice against corn production. Again, this should be considered with caution as water might be a constraint there, especially in hilly areas. The situation in Yunnan is quite similar to it in these three provinces.

⁶ “Strong comparative advantage” refers to low values in both DRCC and RDRCC, meaning comparative advantage not only in the region, but also in the world market; on the contrary, “weak comparative advantage” refers to low value in RDRCC and high value in DRCC, meaning comparative advantage in the region but not in the world market.

Table 6 RDRCCs of Main Grain Crops in the Central Region, by Province

Province		J. Rice	E. Rice	M. Rice	L. Rice	Wheat	Corn	Soybean	Sorghum	Millet
Shanxi	DRCC	0.62	-	-	-	0.78	0.88	1.03	0.67	0.65
	RDRCC	0.79	-	-	-	0.72	0.92	1.15	0.58	0.99
	RANK	3	-	-	-	2	4	6	1	5
Beijing	DRCC	1.01	-	-	-	0.98	1.06	-	-	-
	RDRCC	1.28	-	-	-	0.90	1.11	-	-	-
	RANK	3	-	-	-	1	2	-	-	-
Tianjin	DRCC	0.80	-	-	-	0.77	0.71	-	-	-
	RDRCC	1.02	-	-	-	0.71	0.74	-	-	-
	RANK	3	-	-	-	1	2	-	-	-
Hebei	DRCC	0.78	-	-	-	0.76	0.68	0.73	1.61	0.67
	RDRCC	0.99	-	-	-	0.70	0.71	0.80	1.42	1.02
	RANK	4	-	-	-	1	2	3	6	5
Shandong	DRCC	0.89	-	-	-	1.00	0.96	0.84	-	-
	RDRCC	1.13	-	-	-	0.92	1.00	0.93	-	-
	RANK	4	-	-	-	1	3	2	-	-
Henan	DRCC	0.60	-	0.59	-	0.79	0.78	0.66	-	0.65
	RDRCC	0.76	-	0.74	-	0.72	0.82	0.73	-	0.99
	RANK	4	-	3	-	1	5	2	-	6
Shanghai	DRCC	0.70	-	-	-	0.90	-	-	-	-
	RDRCC	0.89	-	-	-	0.82	-	-	-	-
	RANK	2	-	-	-	1	-	-	-	-
Anhui	DRCC	0.66	1.01	0.69	0.73	0.94	0.69	0.74	-	-
	RDRCC	0.85	1.00	0.86	0.85	0.86	0.72	0.83	-	-
	RANK	3	7	5	4	6	1	2	-	-
Jiangsu	DRCC	0.76	0.81	1.00	-	1.36	1.28	1.02	-	-
	RDRCC	0.97	0.80	1.25	-	1.25	1.34	1.13	-	-
	RANK	2	1	5	-	4	6	3	-	-
Hubei	DRCC	1.00	1.07	0.92	1.07	1.74	1.35	1.29	-	-
	RDRCC	1.28	1.06	1.15	1.26	1.60	1.42	1.43	-	-
	RANK	4	1	2	3	7	5	6	-	-
Zhejiang	DRCC	0.81	1.01	-	0.81	1.19	-	-	-	-
	RDRCC	1.03	0.99	-	0.95	1.09	-	-	-	-
	RANK	3	2	-	1	4	-	-	-	-
Jiangxi	DRCC	-	1.16	-	0.86	-	-	-	-	-
	RDRCC	-	1.14	-	1.01	-	-	-	-	-
	RANK	-	2	-	1	-	-	-	-	-
Hunan	DRCC	-	1.02	-	0.79	1.85	1.16	-	-	-
	RDRCC	-	1.01	-	0.93	1.70	1.22	-	-	-
	RANK	-	2	-	1	4	3	-	-	-
Central	DRCC	0.79	1.01	0.80	0.85	1.09	0.96	0.90	1.14	0.66
	RDRCC	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Note and Source: Ibid.

Table 7 RDRCCs of Main Grain Crops in the South Region, by Province

Province		J. Rice	E. Rice	M. Rice	L. Rice	Wheat	Corn	Soybean	Sorghum	Millet
Zhejiang	DRCC	0.81	1.01	-	0.81	1.19	-	-	-	-
	RDRCC	1.22	1.09	-	0.89	0.96	-	-	-	-
	RANK	4	3	-	1	2	-	-	-	-
Jiangxi	DRCC	-	1.16	-	0.86	-	-	-	-	-
	RDRCC	-	1.26	-	0.95	-	-	-	-	-
	RANK	-	2	-	1	-	-	-	-	-
Hunan	DRCC	-	1.02	-	0.79	1.85	1.16	-	-	-
	RDRCC	-	1.11	-	0.87	1.49	1.14	-	-	-
	RANK	-	2	-	1	4	3	-	-	-
Fujian	DRCC	-	0.96	0.93	0.99	1.39	-	1.27	-	-
	RDRCC	-	1.04	1.39	1.09	1.12	-	1.14	-	-
	RANK	-	1	5	2	3	-	4	-	-
Sichuan	DRCC	-	-	0.66	-	1.21	1.02	-	-	-
	RDRCC	-	-	0.99	-	0.98	0.99	-	-	-
	RANK	-	-	2	-	1	3	-	-	-
Shaanxi	DRCC	-	-	0.61	-	0.95	1.04	1.12	-	0.84
	RDRCC	-	-	0.90	-	0.76	1.02	1.01	-	1.00
	RANK	-	-	2	-	1	4	3	-	3
Chongqing	DRCC	-	-	0.69	-	1.43	1.21	-	-	-
	RDRCC	-	-	1.02	-	1.15	1.18	-	-	-
	RANK	-	-	1	-	2	3	-	-	-
Guizhou	DRCC	0.58	-	0.56	-	1.02	0.86	1.10	-	-
	RDRCC	0.87	-	0.84	-	0.82	0.84	0.99	-	-
	RANK	4	-	2	-	1	3	5	-	-
Yunnan	DRCC	0.61	0.56	0.58	-	0.89	0.78	0.95	-	-
	RDRCC	0.91	0.61	0.87	-	0.72	0.76	0.86	-	-
	RANK	6	1	5	-	2	3	4	-	-
Guangdong	DRCC	-	1.07	-	1.04	-	-	-	-	-
	RDRCC	-	1.16	-	1.14	-	-	-	-	-
	RANK	-	2	-	1	-	-	-	-	-
Guangxi	DRCC	-	0.86	-	0.92	-	1.09	-	-	-
	RDRCC	-	0.93	-	1.01	-	1.07	-	-	-
	RANK	-	1	-	2	-	3	-	-	-
Hainan	DRCC	-	0.74	-	0.95	-	-	-	-	-
	RDRCC	-	0.80	-	1.05	-	-	-	-	-
	RANK	-	1	-	2	-	-	-	-	-
South	DRCC	0.67	0.92	0.67	0.91	1.24	1.02	1.11	-	0.84
	RDRCC	1.00	1.00	1.00	1.00	1.00	1.00	1.00	-	1.00

Note and Source: Ibid.

V. Conclusions

From the above analysis, China as a whole is likely to have strong comparative advantages in Japonica rice, sorghum, middle Indica rice, millet, and late Indica rice as their DRCC values are all equal to or less than 0.85 in current years. Fully utilization of comparative advantages requires some land and other resources being shifted from wheat, soybean, and corn to the above crops in the grain sector. This conclusion is generally true for all the three regions under investigation in this study, except in the case of sorghum production in the Central Region.

The conclusion is a little bit complicated at provincial level. Firstly, the ranks of RDRCCs by province will be used as an important indicator of regional comparative advantage, then the absolute values of the DRCCs will be checked to determine if such comparative advantages hold in the world market. The production of crops with RDRCC rankings at approximately top one third in each province in a region will be marked with a sign of “*”, another same sign will be added if that production is also competitive in the world market. Those at bottom one third will be marked with one sign of “-”, or two such signs if it has DRCC value greater than one. The others will be marked with a “+” sign. Those signs may be considered as plausible directions for structural adjustment in the grain sector. A question mark, “?”, indicates no substitutions for that crop so no information for structural adjustment. Details are listed in Table 8.

According to the above description, expansion of a crop is strongly recommended for a province if the sign of “***” shows in respective places, and somewhat recommended if the sign of “**” is in the place. On the contrary, less production of a crop is recommended or strongly recommended if one or two “-” sign is found in the respective place. No clear conclusions could be drawn in other cases.

However, the quantities of increases and/or decreases in the production of indicated crops remain a crucial topic for future study. The answer depends on resource constraints, on market situations and production technology, as well as their evolutions. The speed of restructuring the grain sector also depends on how fast farmers could adopt new farming practice required for growing new crops, and how easy such shift is allowed and/or facilitated by the existing institutions and other social conditions.

Table 8 Directions of Restructuring the Grain Sector at Provincial Levels

	J. Rice	E. Rice	M. Rice	L. Rice	Wheat	Corn	Soybean	Sorghum	Millet
Beijing	--	n.a.	n.a.	n.a.	?	*	n.a.	n.a.	n.a.
Tianjin	-	n.a.	n.a.	n.a.	?	**	n.a.	n.a.	n.a.
Hebei	+	n.a.	n.a.	n.a.	?	**	+	--	-
Shanxi	+	n.a.	n.a.	n.a.	?	-	--	**	+
Inner Mongolia	-	n.a.	n.a.	n.a.	+	**	+	**	-
Liaoning	+	n.a.	n.a.	n.a.	--	+	**	**	-
Jilin	+	n.a.	n.a.	n.a.	+	--	**	-	**
Heilongjiang	-	n.a.	n.a.	n.a.	+	-	**	+	n.a.
Shanghai	?	n.a.	n.a.	n.a.	?	n.a.	n.a.	n.a.	n.a.
Jiangsu	**	**	--	n.a.	+	--	+	n.a.	n.a.
Zhejiang	-	+	n.a.	**	?	n.a.	n.a.	n.a.	n.a.
Anhui	+	--	-	+	?	**	**	n.a.	n.a.
Fujian	n.a.	**	-	**	?	n.a.	+	n.a.	n.a.
Jiangxi	n.a.	?	n.a.	?	n.a.	n.a.	n.a.	n.a.	n.a.
Shandong	-	n.a.	n.a.	n.a.	?	+	**	n.a.	n.a.
Henan	+	n.a.	**	n.a.	?	+	**	n.a.	-
Hubei	+	*	**	+	?	--	--	n.a.	n.a.
Hunan	n.a.	+	n.a.	**	?	--	n.a.	n.a.	n.a.
Guangdong	n.a.	?	n.a.	?	n.a.	n.a.	n.a.	n.a.	n.a.
Guangxi	n.a.	**	n.a.	+	n.a.	--	n.a.	n.a.	n.a.
Hainan	n.a.	?	n.a.	?	n.a.	n.a.	n.a.	n.a.	n.a.
Sichuan	n.a.	n.a.	**	n.a.	?	--	n.a.	n.a.	n.a.
Guizhou	+	n.a.	**	n.a.	?	**	--	n.a.	n.a.
Yunnan	-	**	+	n.a.	?	**	+	n.a.	n.a.
Shaanxi	n.a.	n.a.	**	n.a.	?	--	--	n.a.	+
Gansu	n.a.	n.a.	n.a.	n.a.	?	**	n.a.	n.a.	--
Qinghai	n.a.	n.a.	n.a.	n.a.	?	n.a.	n.a.	n.a.	n.a.
Ningxia	+	n.a.	n.a.	n.a.	?	**	-	n.a.	n.a.
Xinjiang	-	n.a.	n.a.	n.a.	+	**	n.a.	n.a.	n.a.
Chongqing	n.a.	n.a.	**	n.a.	?	--	n.a.	n.a.	n.a.

Note: J. Rice = *Japonica* rice, E. Rice = early rice (*Indica*), M. Rice = middle rice (*Indica*), L. Rice = late rice (*Indica*), and n.a. = no data available. All DRCC figures are 1996-98 averages.

Source: Calculated with data published in Compilation of National Cost-Benefit Data of Farm Products (Quanguo Nongchanping Chengben Shouyi Ziliao Huibian), 1997-99.

References

- Anderson K., (1990) "Changing Comparative Advantage in China: Effects on Food, Feed and Fiber Markets", OECD;
- Bruno M., (1972) "Domestic Resource Cost and Effective Protection: Clarification and Synthesis", *Journal of Political Economy*;
- Cheng Fang and John Beghin, "Self-sufficiency, Comparative Advantage, and Agricultural Trade: A Policy Analysis Matrix for Chinese Agriculture", A paper presented at the Symposium on China's Agricultural Trade and Policy: Issues, Analysis, and Global Consequences, June 25-26, 1999, in San Francisco, California;
- Colin A. Carter and Fu-Ning Zhong, (1991) "Will Market Prices Enhance Chinese Agriculture? A Test of Regional Comparative Advantage", *Western Journal of Agricultural Economics*;
- Colin A. Carter and Fu-Ning Zhong, (1988) "Regional Comparative Advantage in Chinese

- Agriculture”, in CHINA’S RURAL DEVELOPMENT MIRACLE, Longworth (ed.), Queensland University Press, Australia;
- Monke, E. A. and Pearson, S. R., (1989) The Policy Analysis Matrix for Agricultural Development, Ithaca and London: Cornell University Press;
- Pearson, S. R., (1973) “Net Profitability, Domestic Resource Costs, and Effective Rate of Production”, Food Research Institute, Stanford University, Monograph;
- Pearson, S. R. and P. K. Mayer, (1974) “Comparative Advantage Among African Coffee Producer”, *American Journal of Agricultural Economics*;
- World Bank, (1985) China: Long Term Development Issues and Options, Baltimore: John Hopkins University Press;
- Cai, Fang, (1994) “Bijiao Youshi Yu Nongye Fazhan Zhebgce (Comparative Advantage and Agricultural Development Policy)”, *Jingji Yanjiu(Economic Research)*;
- Cai, Fang, (1992) “Quyu Bijiao Youshi Yu Nongye Chixu Zengzhang De Yuanquan (Regional Comparative Advantage and the Source of Sustainable Growth in Agriculture)”, *Zhongguo Nongcun Jingji(Chinese Rural Economy)*;
- State Development and Planning Commission, etc., Quanguo Nongchanpin Chengben Shouyi Ziliao Huibian(National Compilation of Cost-Benefit Statistics of Farm Products), various issues. Beijing: China Price Press;
- State Planning Commission and Ministry of Construction, (1993) Jianshe Xiangmu Jingji Pingjia Fangfa Yu canshu (Economic Methods and Parameters in Construction Project Evaluations),. Beijing: China Planning Press, the second edition;
- State Statistics Bureau, Zhongguo Tongji Nianjian (China Statistical Yearbook), various issues. Beijing: China Statistics Press;
- State Statistics Bureau Urban Social and Economic Survey Team, Zhongguo Wujia Tongji Nianjian (China Price Statistical Yearbook), various issues. Beijing: China Statistics Press;
- State Statistics Bureau Trade and Foreign Economic Statistics Department, Zhongguo Duiwai Jingji Tongji Nianjian (China Foreign Economic Statistical Yearbook), various issues. Beijing: China Statistics Press;
- Li, Yingzhong, (1997) Zhongguo Nongye Quhuaxue (China Agricultural Zoning). Beijing: China Agricultural Science and Technology Press;
- Peng, Tingjun and Guoqiang Cheng, (1999) “Zhongguo Nongchanpin Guonei Ziyuan Chengben De Guji (Estimation of the Domestic Resource Costs for Chinese Agricultural Products)”, *Zhongguo Nongcun GuanCha (Chinese Rural Survey)*;
- Xu, Zhigang, Longbo Fu and Funing Zhong, (forthcoming) “Zhongguo Liangshi Shengchan De Quyu Bijiao Youshi Fenxi (Analysis of Regional Comparative Advantage in Chinese Grain Production)”, *Zhongguo Nongye Ziyuan Yu Quhua (China Agricultural Resource and Zoning)*;
- Xu, Zhigang, Funing Zhong and Longbo Fu, (forthcoming) “Zhongguo Nongchanpin De Guonei Ziyuan Chengben Ji Bijiao Youshi (Domestic Resource Costs and Comparative Advantage of Chinese Agricultural Products)”, *Nongye Jishu Jingji (Journal of Agrotechnical Economics)*;

Appendix

Table A-1 RDRCCs of Main Grain Crops in the North Region, by Crop

Province		J. Rice	E. Rice	M. Rice	L. Rice	Wheat	Corn	Soybean	Sorghum	Millet
Heilongjiang	DRCC	0.79	-	-	-	0.91	0.89	0.87	0.75	-
	RDRCC	1.11	-	-	-	1.00	1.04	0.94	1.01	-
	RANK	6	-	-	-	6	6	2	4	-
Jilin	DRCC	0.61	-	-	-	1.08	1.07	0.71	0.96	0.42
	RDRCC	0.85	-	-	-	1.19	1.24	0.76	1.29	0.52
	RANK	1	-	-	-	10	9	1	5	1
Liaoning	DRCC	0.74	-	-	-	1.03	0.93	0.91	0.71	0.98
	RDRCC	1.04	-	-	-	1.14	1.08	0.97	0.95	1.22
	RANK	5	-	-	-	9	7	3	3	4
Inner Mongolia	DRCC	0.96	-	-	-	0.87	0.82	0.97	0.66	0.86
	RDRCC	1.35	-	-	-	0.96	0.95	1.04	0.87	1.07
	RANK	7	-	-	-	4	4	5	1	3
Shanxi	DRCC	0.62	-	-	-	0.78	0.88	1.03	0.67	0.65
	RDRCC	0.87	-	-	-	0.86	1.02	1.11	0.89	0.81
	RANK	2	-	-	-	2	5	6	2	2
Shaanxi	DRCC	-	-	0.61	-	0.95	1.04	1.12	-	0.84
	RDRCC	-	-	1.00	-	1.04	1.21	1.20	-	1.04
	RANK	-	-	1	-	7	8	7	-	2
Gansu	DRCC	-	-	-	-	0.89	0.81	-	-	1.07
	RDRCC	-	-	-	-	0.98	0.94	-	-	1.34
	RANK	-	-	-	-	5	3	-	-	5
Qinghai	DRCC	-	-	-	-	0.97	-	-	-	-
	RDRCC	-	-	-	-	1.06	-	-	-	-
	RANK	-	-	-	-	8	-	-	-	-
Ningxia	DRCC	0.63	-	-	-	0.83	0.62	0.92	-	-
	RDRCC	0.88	-	-	-	0.91	0.72	0.99	-	-
	RANK	3	-	-	-	3	1	4	-	-
Xinjiang	DRCC	0.65	-	-	-	0.77	0.69	-	-	-
	RDRCC	0.91	-	-	-	0.85	0.80	-	-	-
	RANK	4	-	-	-	2	2	-	-	-
North	DRCC	0.72	-	0.61	-	0.91	0.86	0.93	0.75	0.80
	RDRCC	1.00	-	1.00	-	1.00	1.00	1.00	1.00	1.00

Note: J. Rice = *Japonica* rice, E. Rice = early rice (*Indica*), M. Rice = middle rice (*Indica*), and L. Rice = late rice (*Indica*). All DRCC figures are 1996-98 averages.

Source: Calculated with data published in Compilation of National Cost-Benefit Data of Farm Products (Quanguo Nongchanping Chengben Shouyi Ziliao Huibian), 1997-99.

Table A-2 RDRCCs of Main Grain Crops in the Central Region, by Crop

Province		J. Rice	E. Rice	M. Rice	L. Rice	Wheat	Corn	Soybean	Sorghum	Millet
	DRCC	0.62	-	-	-	0.78	0.88	1.03	0.67	0.65

Shanxi	RDRCC	0.79	-	-	-	0.72	0.92	1.15	0.58	0.99
	RANK	2	-	-	-	3	5	6	1	1
Beijing	DRCC	1.01	-	-	-	0.98	1.06	-	-	-
	RDRCC	1.28	-	-	-	0.90	1.11	-	-	-
	RANK	11	-	-	-	7	7	-	-	-
Tianjin	DRCC	0.80	-	-	-	0.77	0.71	-	-	-
	RDRCC	1.02	-	-	-	0.71	0.74	-	-	-
	RANK	7	-	-	-	2	3	-	-	-
Hebei	DRCC	0.78	-	-	-	0.76	0.68	0.73	1.61	0.67
	RDRCC	0.99	-	-	-	0.70	0.71	0.80	1.42	1.02
	RANK	6	-	-	-	1	1	2	2	3
Shandong	DRCC	0.89	-	-	-	1.00	0.96	0.84	-	-
	RDRCC	1.13	-	-	-	0.92	1.00	0.93	-	-
	RANK	9	-	-	-	8	6	4	-	-
Henan	DRCC	0.60	-	0.59	-	0.79	0.78	0.66	-	0.65
	RDRCC	0.76	-	0.74	-	0.72	0.82	0.73	-	0.99
	RANK	1	-	1	-	4	4	1	-	2
Shanghai	DRCC	0.70	-	-	-	0.90	-	-	-	-
	RDRCC	0.89	-	-	-	0.82	-	-	-	-
	RANK	4	-	-	-	5	-	-	-	-
Anhui	DRCC	0.66	1.01	0.69	0.73	0.94	0.69	0.74	-	-
	RDRCC	0.85	1.00	0.86	0.85	0.86	0.72	0.83	-	-
	RANK	3	3	2	1	6	2	3	-	-
Jiangsu	DRCC	0.76	0.81	1.00	-	1.36	1.28	1.02	-	-
	RDRCC	0.97	0.80	1.25	-	1.25	1.34	1.13	-	-
	RANK	5	1	4	-	10	9	5	-	-
Hubei	DRCC	1.00	1.07	0.92	1.07	1.74	1.35	1.29	-	-
	RDRCC	1.28	1.06	1.15	1.26	1.60	1.42	1.43	-	-
	RANK	10	5	3	5	11	10	7	-	-
Zhejiang	DRCC	0.81	1.01	-	0.81	1.19	-	-	-	-
	RDRCC	1.03	0.99	-	0.95	1.09	-	-	-	-
	RANK	8	2	-	3	9	-	-	-	-
Jiangxi	DRCC	-	1.16	-	0.86	-	-	-	-	-
	RDRCC	-	1.14	-	1.01	-	-	-	-	-
	RANK	-	6	-	4	-	-	-	-	-
Hunan	DRCC	-	1.02	-	0.79	1.85	1.16	-	-	-
	RDRCC	-	1.01	-	0.93	1.70	1.22	-	-	-
	RANK	-	4	-	2	12	8	-	-	-
Central	DRCC	0.79	1.01	0.80	0.85	1.09	0.96	0.90	1.14	0.66
	RDRCC	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Note and Source: Ibid.

Table A-3 RDRCCs of Main Grain Crops in the South Region, by Crop

Province	J. Rice	E. Rice	M. Rice	L. Rice	Wheat	Corn	Soybean	Sorghum	Millet
	DRCC	0.81	1.01	-	0.81	1.19	-	-	-

Zhejiang	RDRCC	1.22	1.09	-	0.89	0.96	-	-	-	-
	RANK	3	5	-	2	4	-	-	-	-
Jiangxi	DRCC	-	1.16	-	0.86	-	-	-	-	-
	RDRCC	-	1.26	-	0.95	-	-	-	-	-
Hunan	RANK	-	8	-	3	-	-	-	-	-
	DRCC	-	1.02	-	0.79	1.85	1.16	-	-	-
Fujian	RDRCC	-	1.11	-	0.87	1.49	1.14	-	-	-
	RANK	-	6	-	1	8	6	-	-	-
Sichuan	DRCC	-	0.96	0.93	0.99	1.39	-	1.27	-	-
	RDRCC	-	1.04	1.39	1.09	1.12	-	1.14	-	-
Shaanxi	RANK	-	4	5	6	6	-	4	-	-
	DRCC	-	-	0.66	-	1.21	1.02	-	-	-
Chongqing	RDRCC	-	-	0.99	-	0.98	0.99	-	-	-
	RANK	-	-	3	-	5	3	-	-	-
Guizhou	DRCC	-	-	0.61	-	0.95	1.04	1.12	-	0.84
	RDRCC	-	-	0.90	-	0.76	1.02	1.01	-	1.00
Yunnan	RANK	-	-	2	-	2	4	3	-	1
	DRCC	-	-	0.69	-	1.43	1.21	-	-	-
Guangdong	RDRCC	-	-	1.02	-	1.15	1.18	-	-	-
	RANK	-	-	4	-	7	7	-	-	-
Guangxi	DRCC	0.58	-	0.56	-	1.02	0.86	1.10	-	-
	RDRCC	0.87	-	0.84	-	0.82	0.84	0.99	-	-
Hainan	RANK	1	-	1	-	3	2	2	-	-
	DRCC	0.61	0.56	0.58	-	0.89	0.78	0.95	-	-
South	RDRCC	0.91	0.61	0.87	-	0.72	0.76	0.86	-	-
	RANK	2	1	2	-	1	1	1	-	-
South	DRCC	-	1.07	-	1.04	-	-	-	-	-
	RDRCC	-	1.16	-	1.14	-	-	-	-	-
South	RANK	-	7	-	7	-	-	-	-	-
	DRCC	-	0.86	-	0.92	-	1.09	-	-	-
South	RDRCC	-	0.93	-	1.01	-	1.07	-	-	-
	RANK	-	3	-	4	-	5	-	-	-
South	DRCC	-	0.74	-	0.95	-	-	-	-	-
	RDRCC	-	0.80	-	1.05	-	-	-	-	-
South	RANK	-	2	-	5	-	-	-	-	-
	DRCC	0.67	0.92	0.67	0.91	1.24	1.02	1.11	-	0.84
	RDRCC	1.00	1.00	1.00	1.00	1.00	1.00	1.00	-	1.00

Note and Source: Ibid.